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Operations Status and AIRS Trends

Denis Elliott

November 16, 2012

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AIRS Operations Status

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AIRS Operational Status

- **AIRS is in excellent health**
- **All engineering parameter plots versus time are either flat or changing extremely slowly—no concerns**
- **Some channels have degraded noise performance due to radiation dosage**
  - ***Many of the degraded channels had their noise performance significantly improved last January by revising the on-board gain table***

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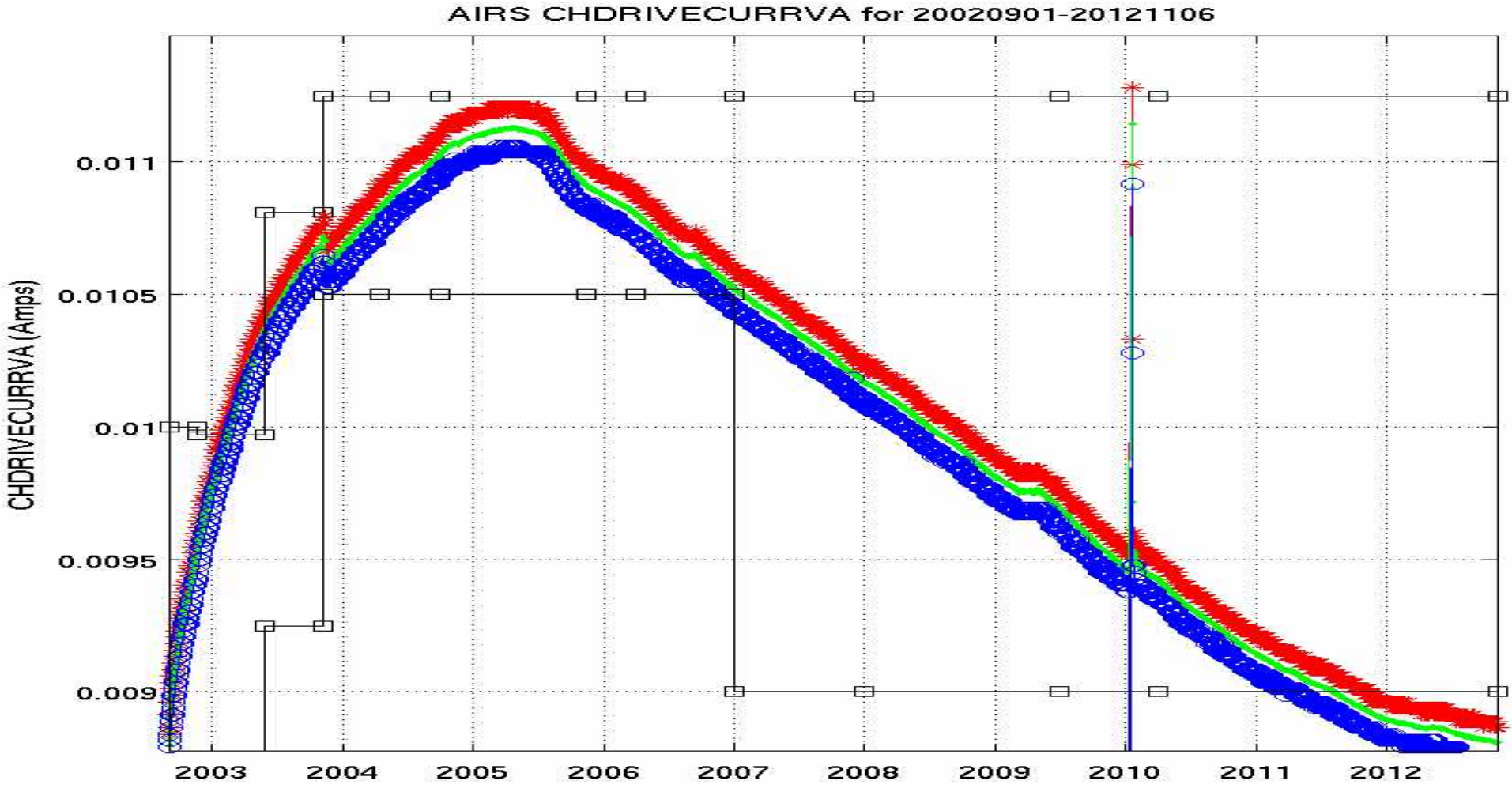
AIRS Chopper Drive Current



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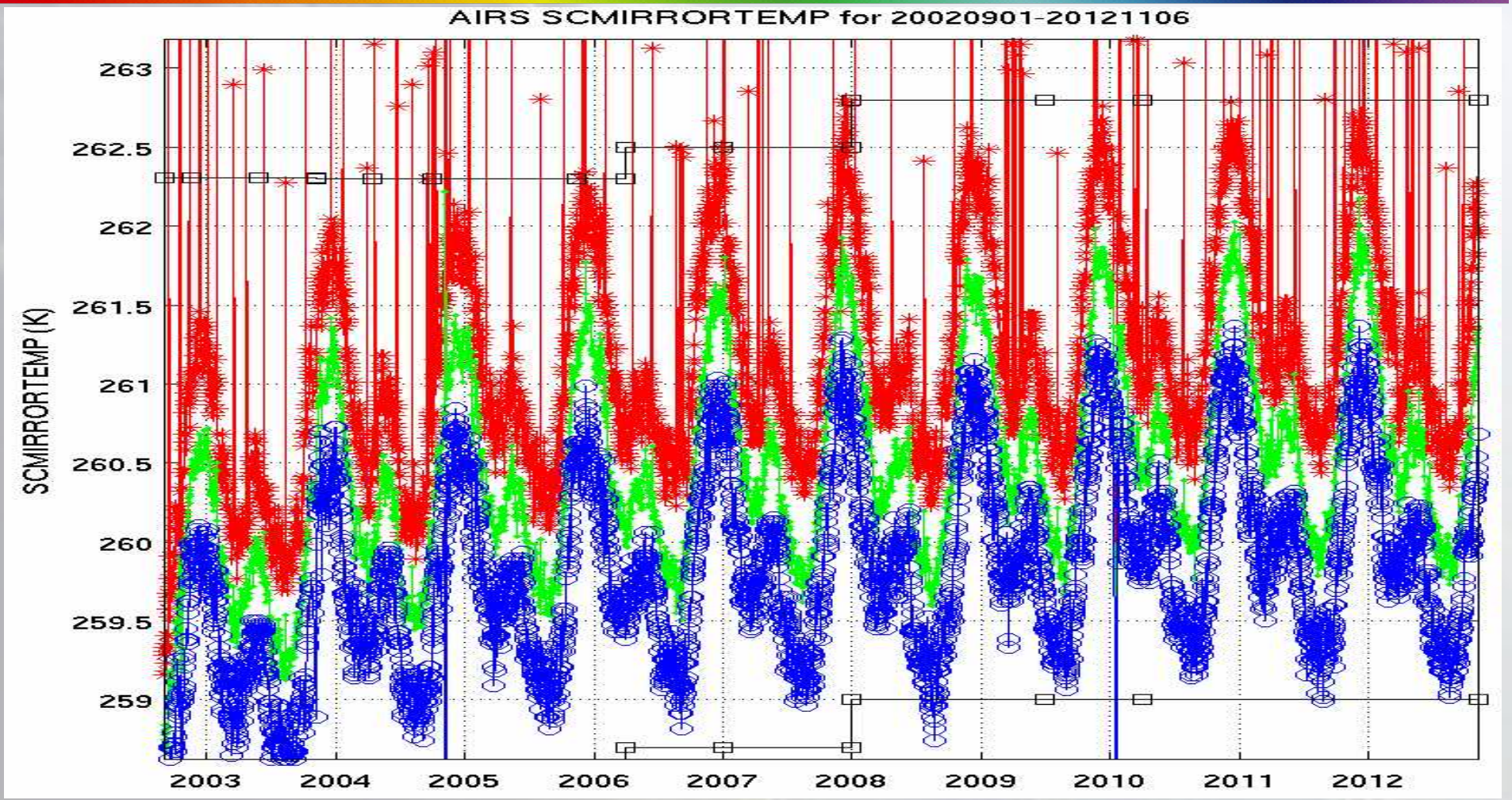
AIRS Scan Mirror Temperature



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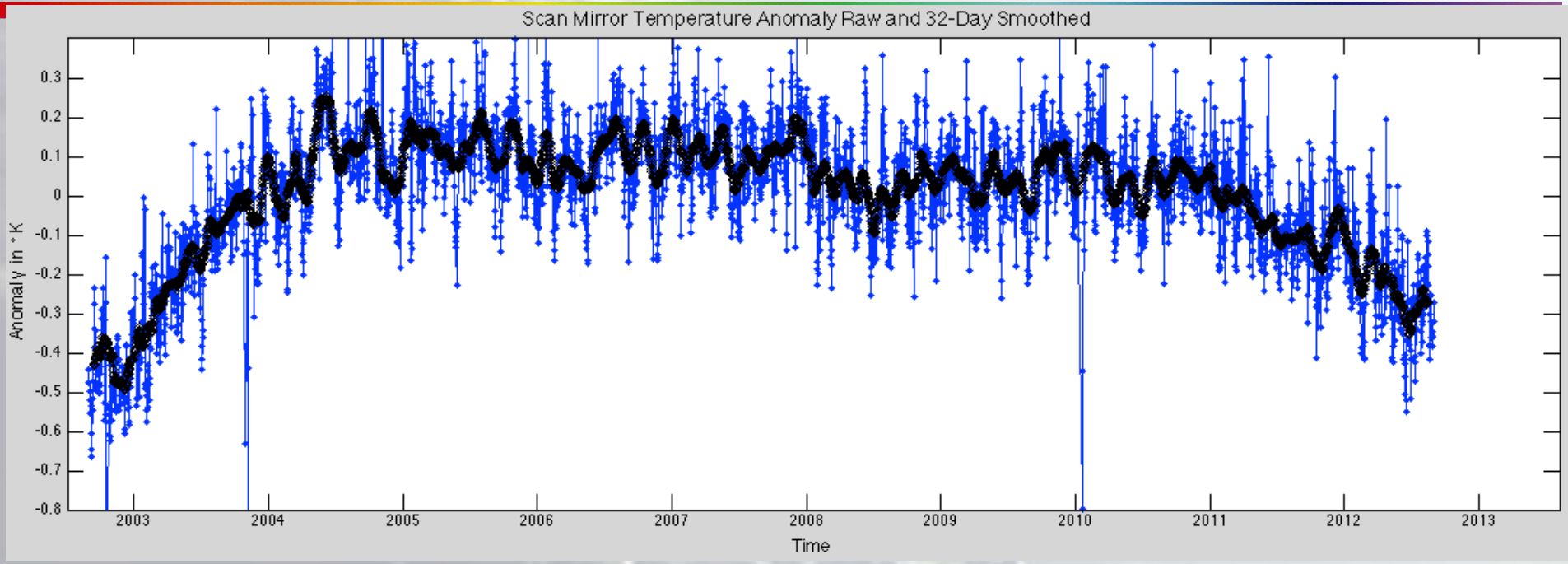
AIRS Scan Mirror Temperature Anomaly Trend



- **The scan mirror temperature anomaly is the difference between the measured temperature and a fit that follows seasonal variations**

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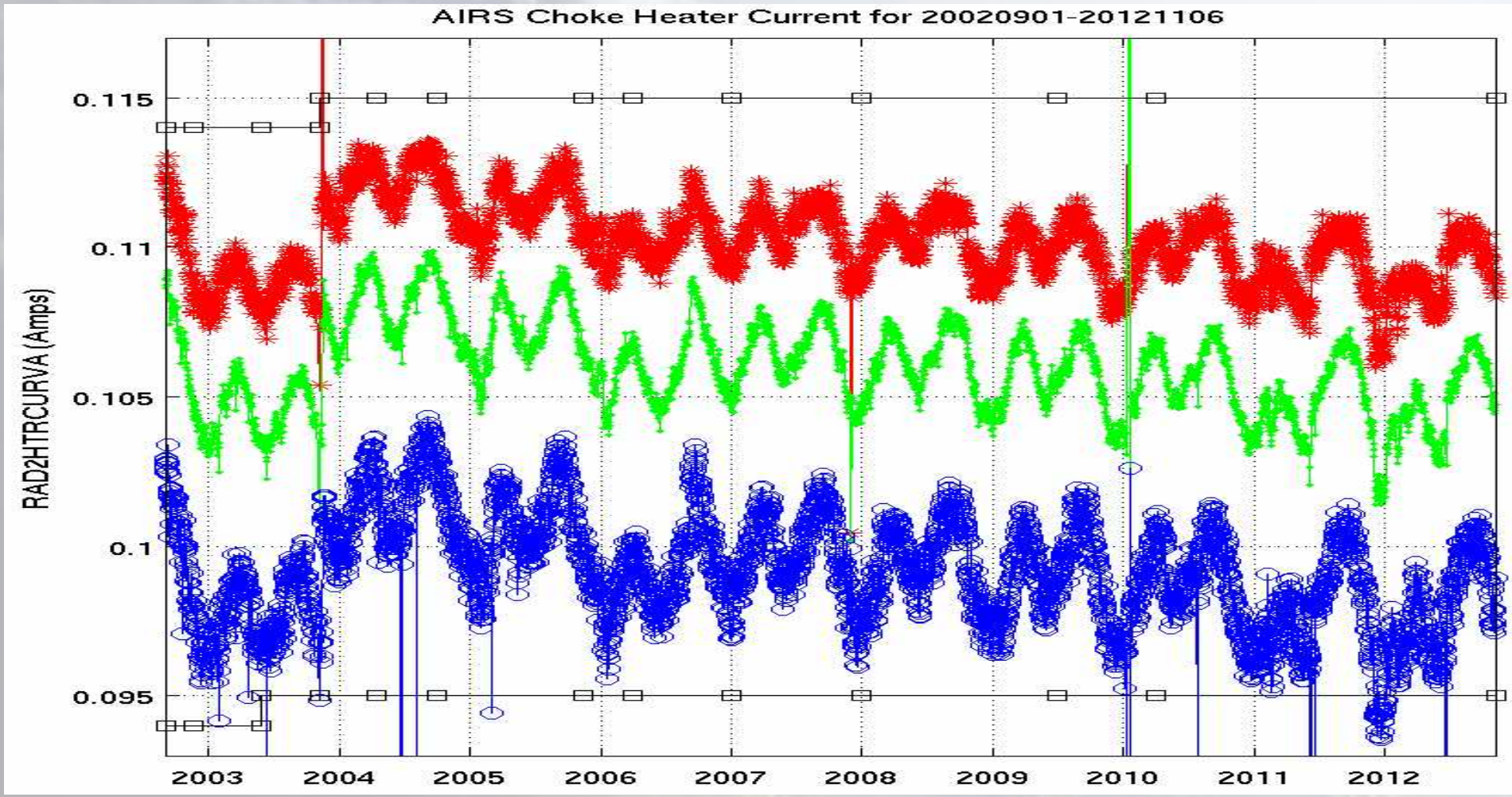
AIRS Choke Point Heater Current



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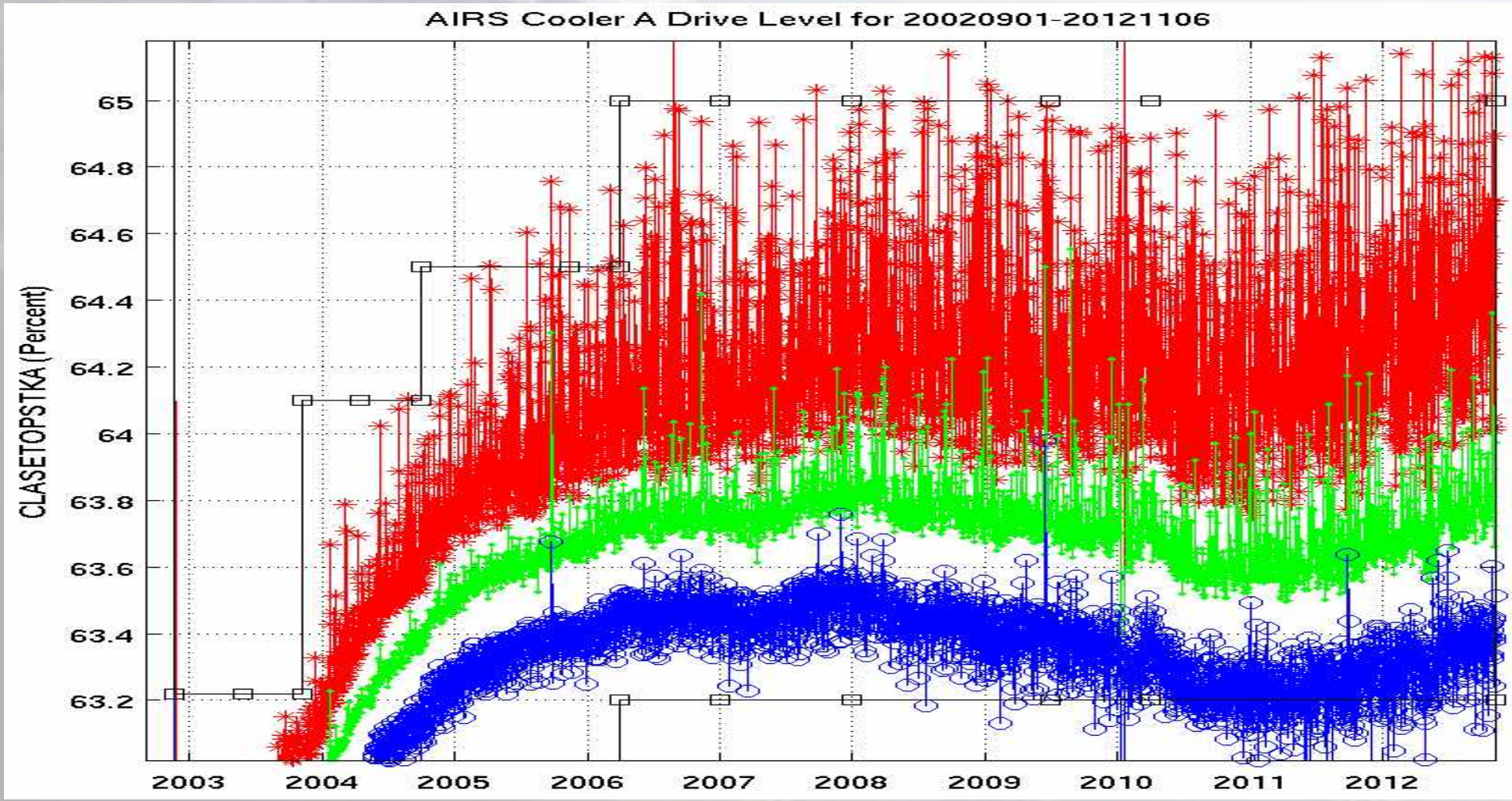
AIRS Cooler A Drive Level



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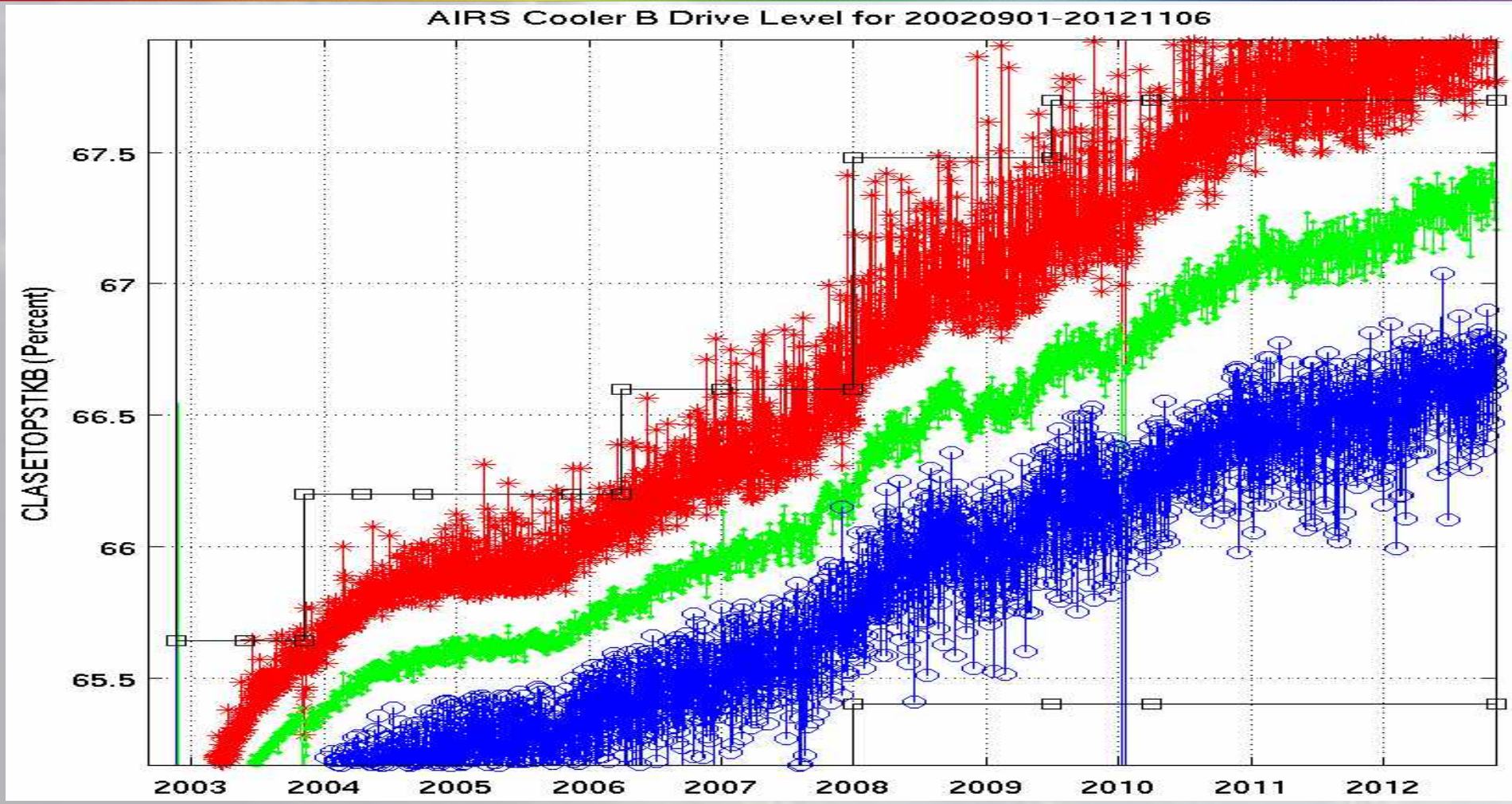
AIRS Cooler B Drive Level



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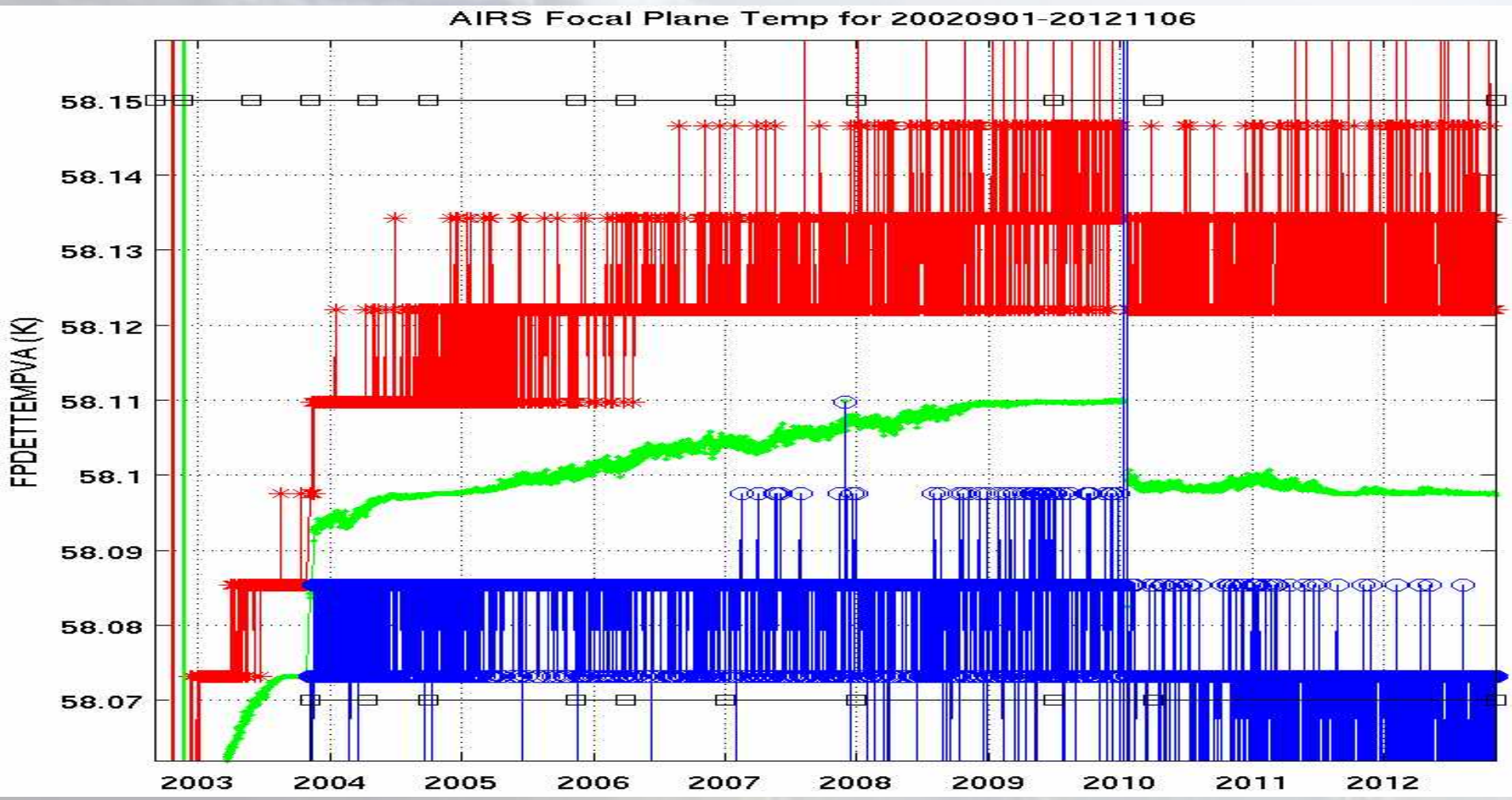
AIRS Focal Plane Temperature



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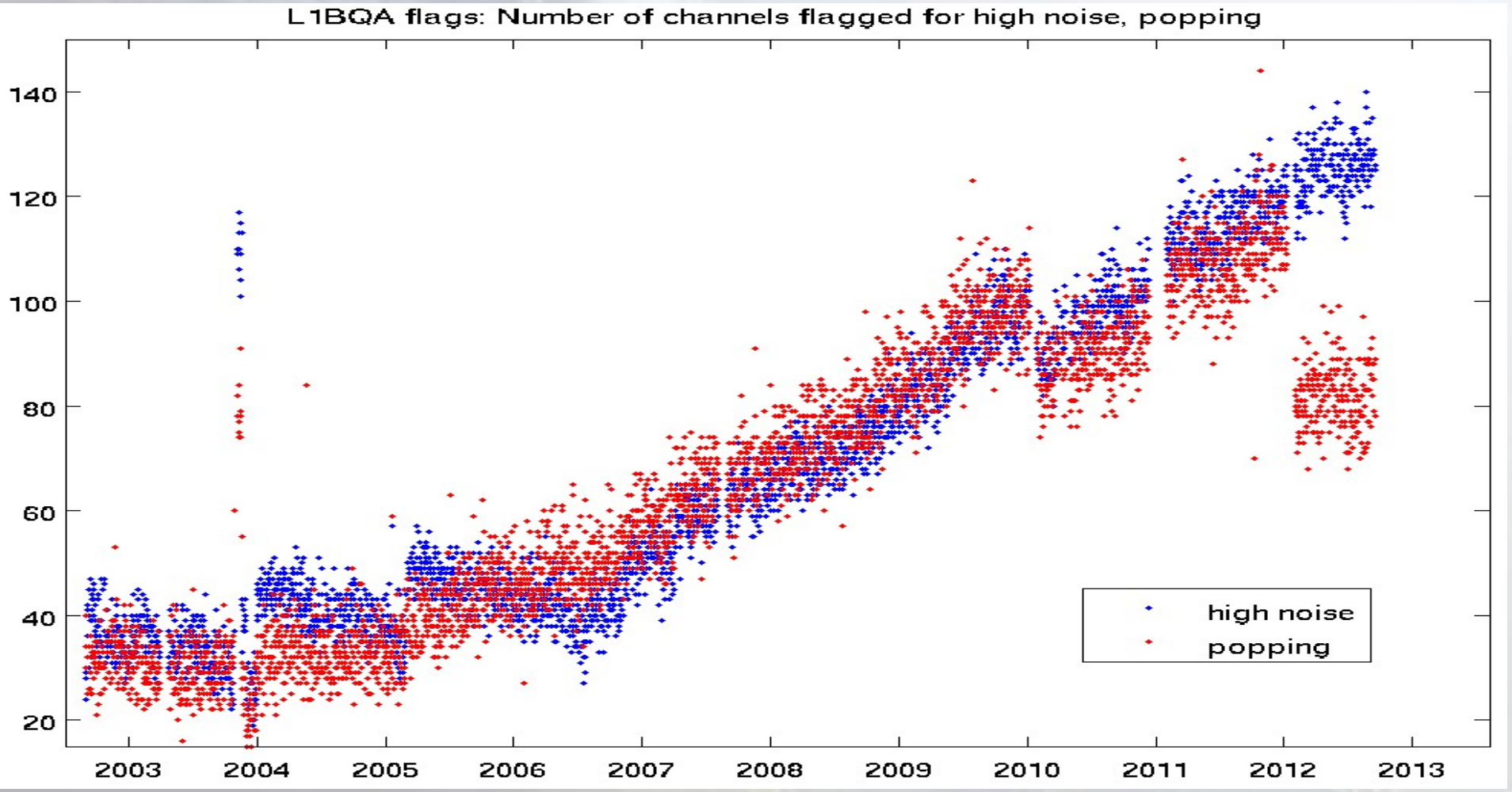
Effect of January gain table change



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AMSU-A Status

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AMSU-A Operational Status

- **AMSU-A mechanical parts and most of the electronics are in good health**
- **All engineering parameter trends are slow**
- **The A1-1 and A1-2 scanner currents are rising, but very slowly and are not alarming**
- **10 of the 15 channels are healthy, but**
  - ***Channel 4 failed in 2007 (declared non-operational on October 1 2007)***
  - ***Channel 5 is now too noisy to contribute to Level 2***
  - ***Channel 7 noise has exceeded specs since launch and has never been used for L2***
  - ***Channel 6 has been degrading slowly since 2008, but is still a good channel—its NEΔT may actually be oscillatory (see later chart)***
  - ***Channel 1 began degrading in January 2012, but is still a good channel***

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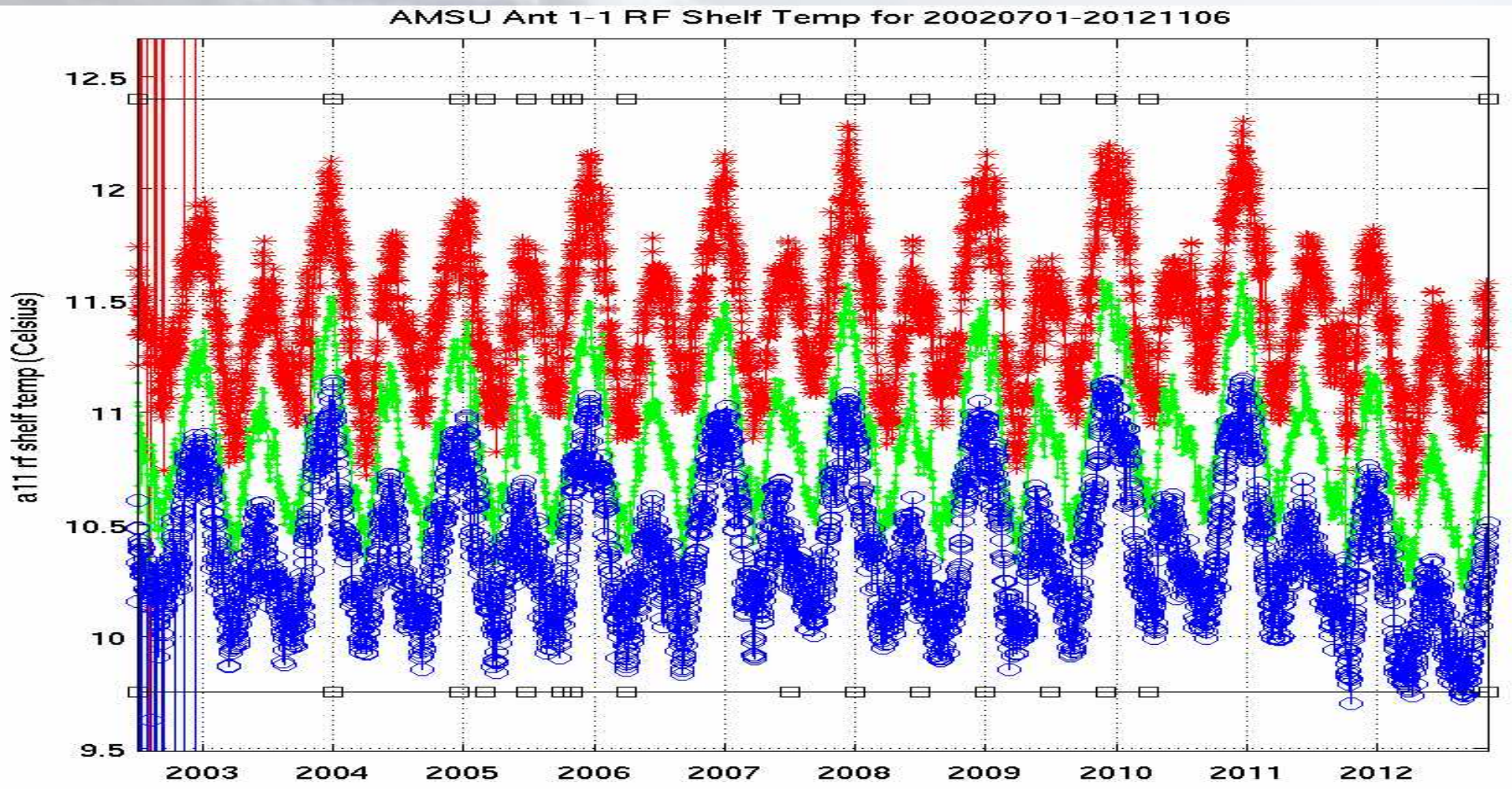
AMSU-A1-1 RF Shelf Temperature



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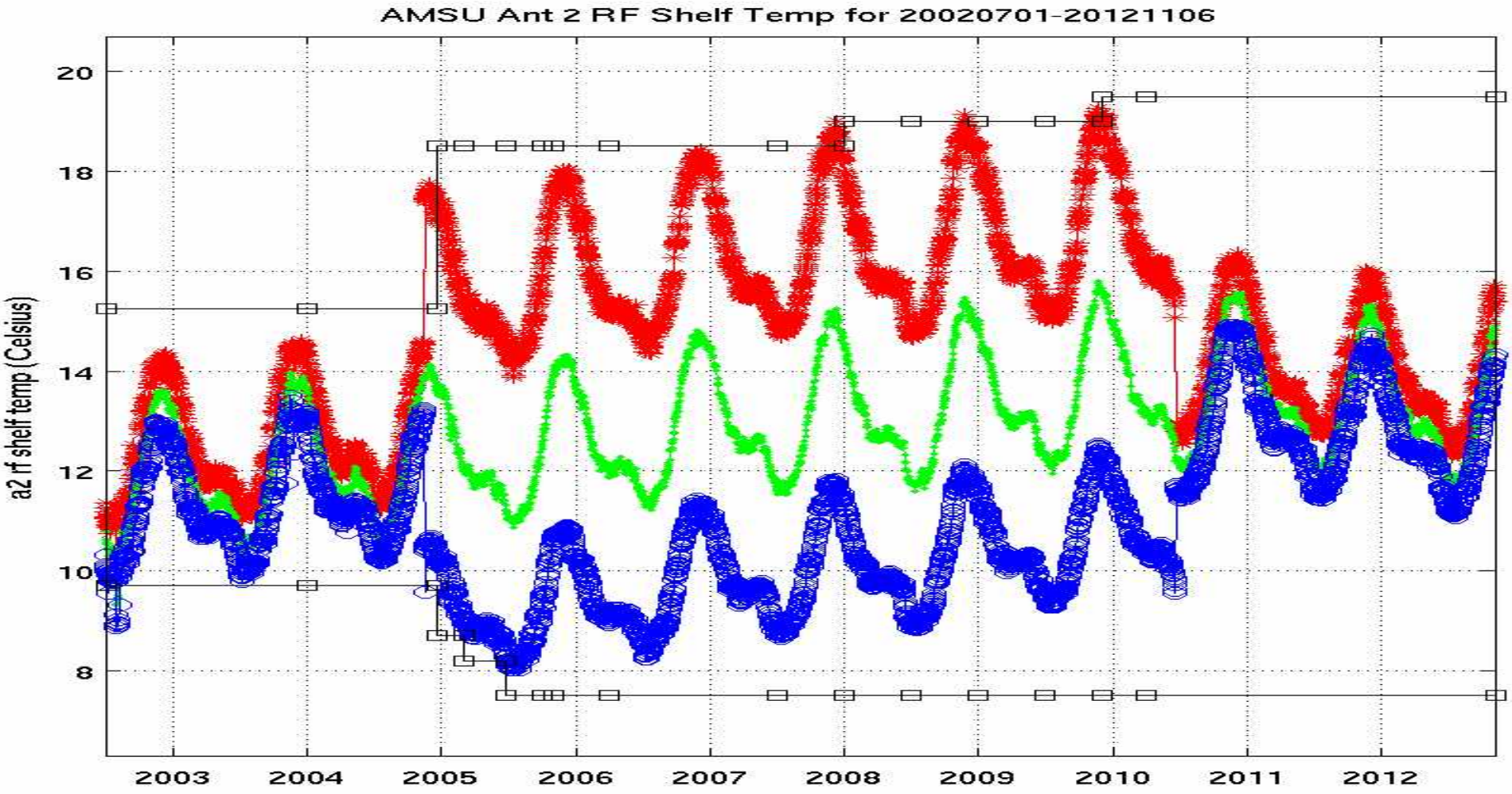
AMSU-A2 RF Shelf Temperature



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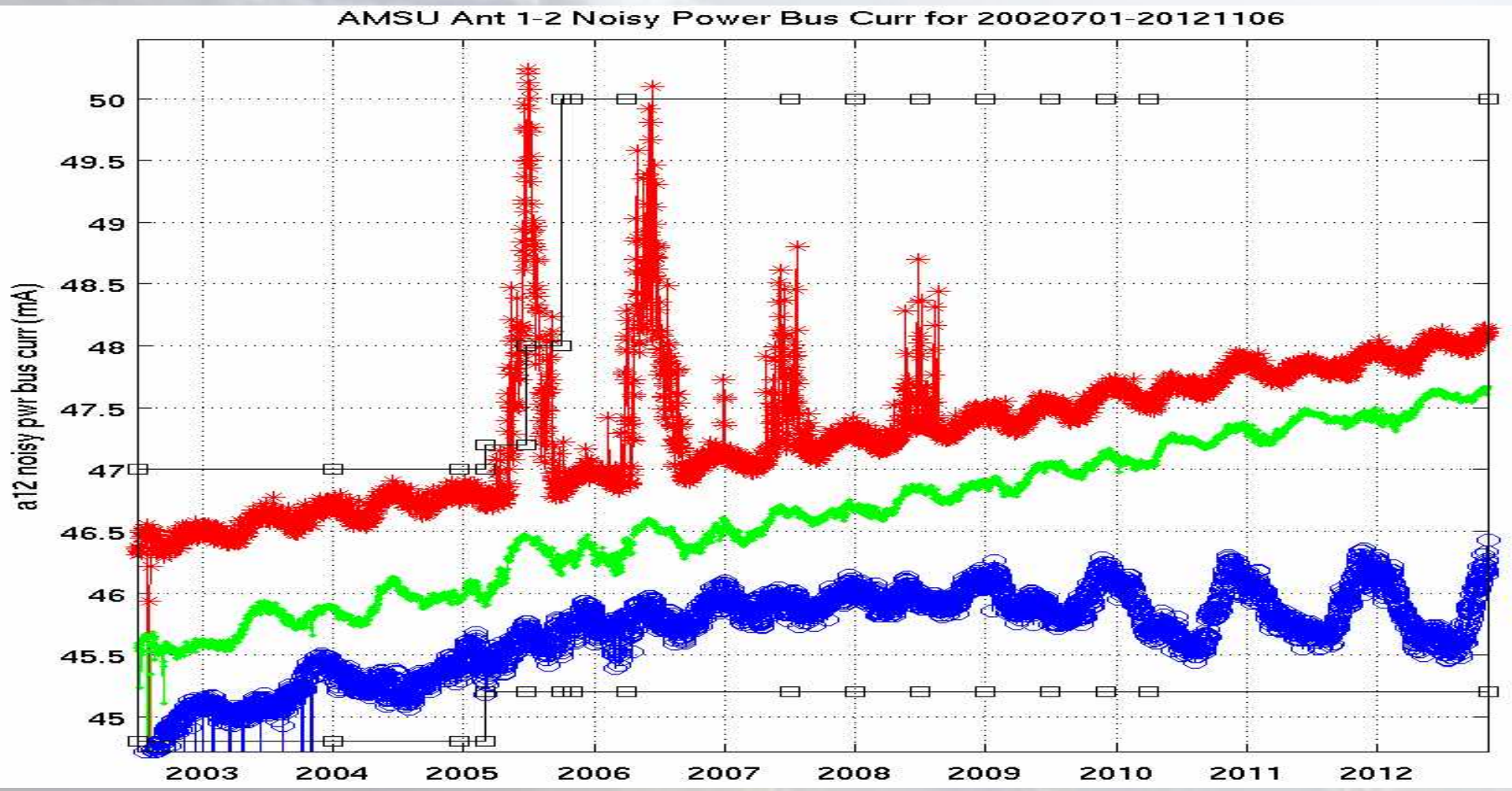
AMSU-A1-2 Noisy Bus Current



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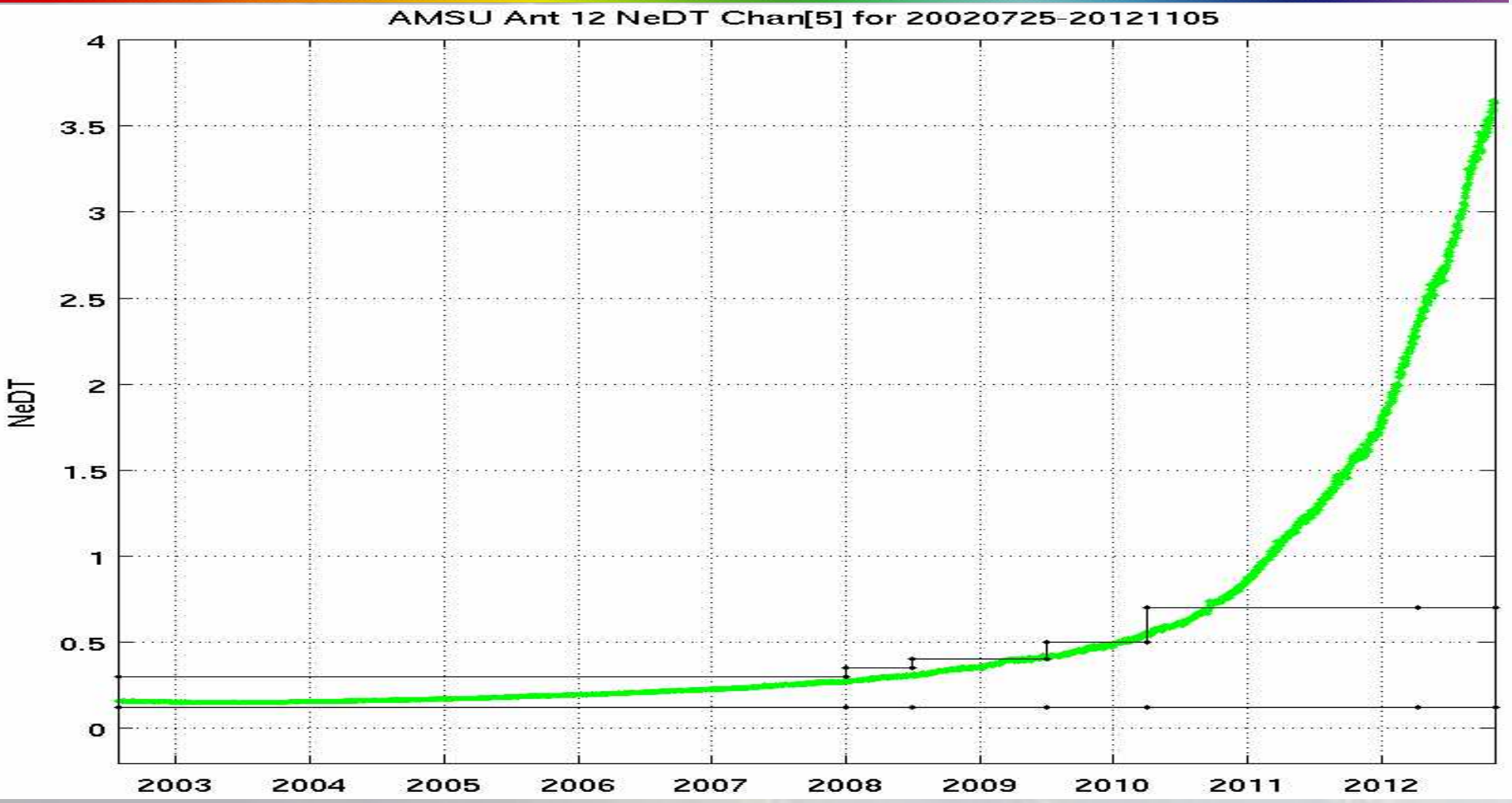
AMSU-A Channel 5 NEΔT



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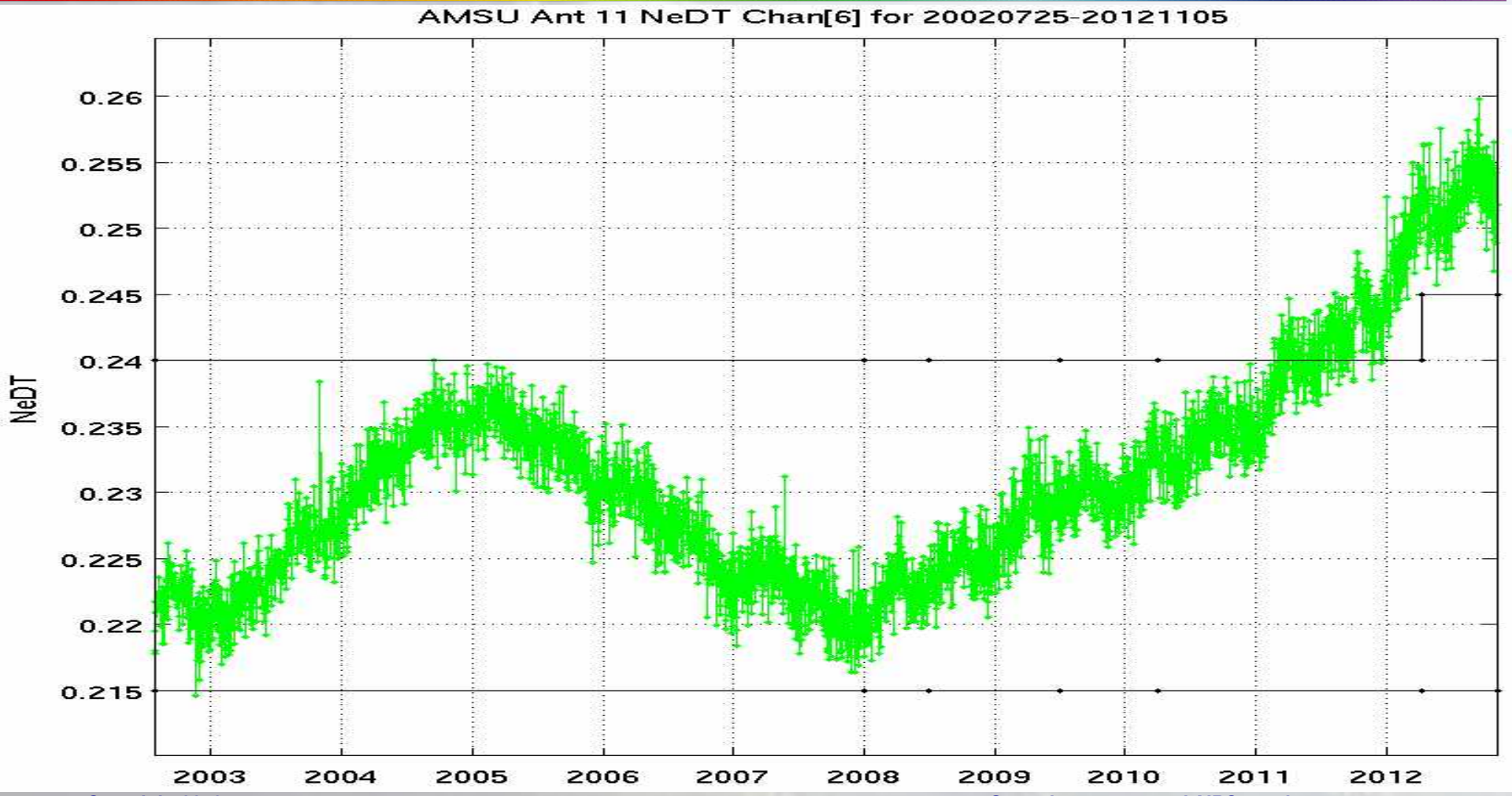
AMSU-A Channel 6 NEΔT



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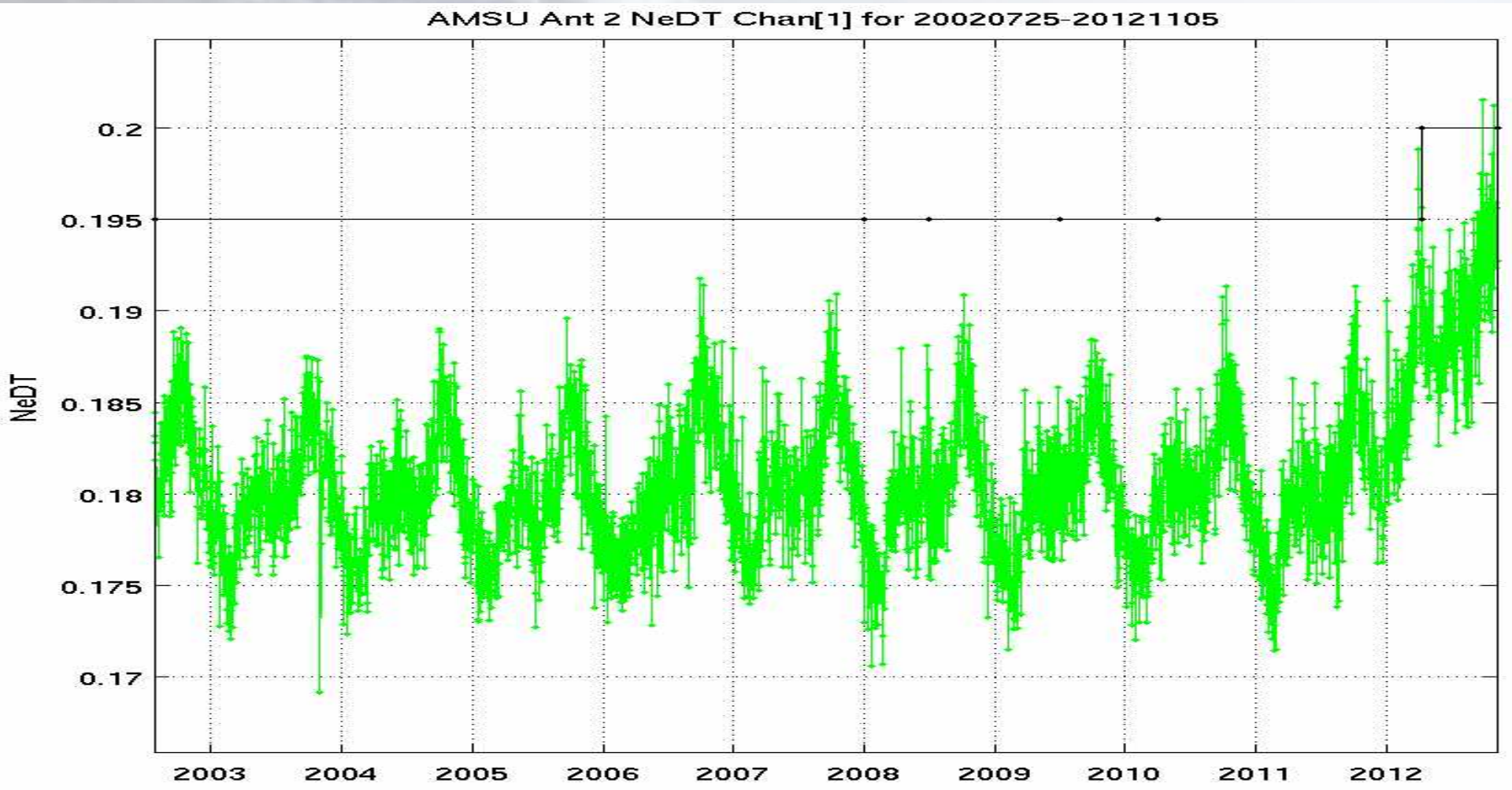
AMSU-A Channel 1 NEΔT



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Aqua Status And Anomalies

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Aqua Spacecraft Health Status

- Aqua is in very good health
- Several anomalies have occurred over the years
- All are considered minor
- None have yet impacted operations

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Aqua Fuel Supply

- **Occasional drag make up burns use only a very small amount of fuel**

- **Most fuel usage takes place in orbital inclination adjustment maneuvers, needed to keep Aqua properly aligned with other A-train instruments and to tightly control our 1:30 pm crossing time**
  - ***Three or four such maneuvers are planned every year, near the vernal equinox***
  - ***A recent estimate of future fuel usage indicates that the hydrazine should last at least until 2020, and possibly longer***

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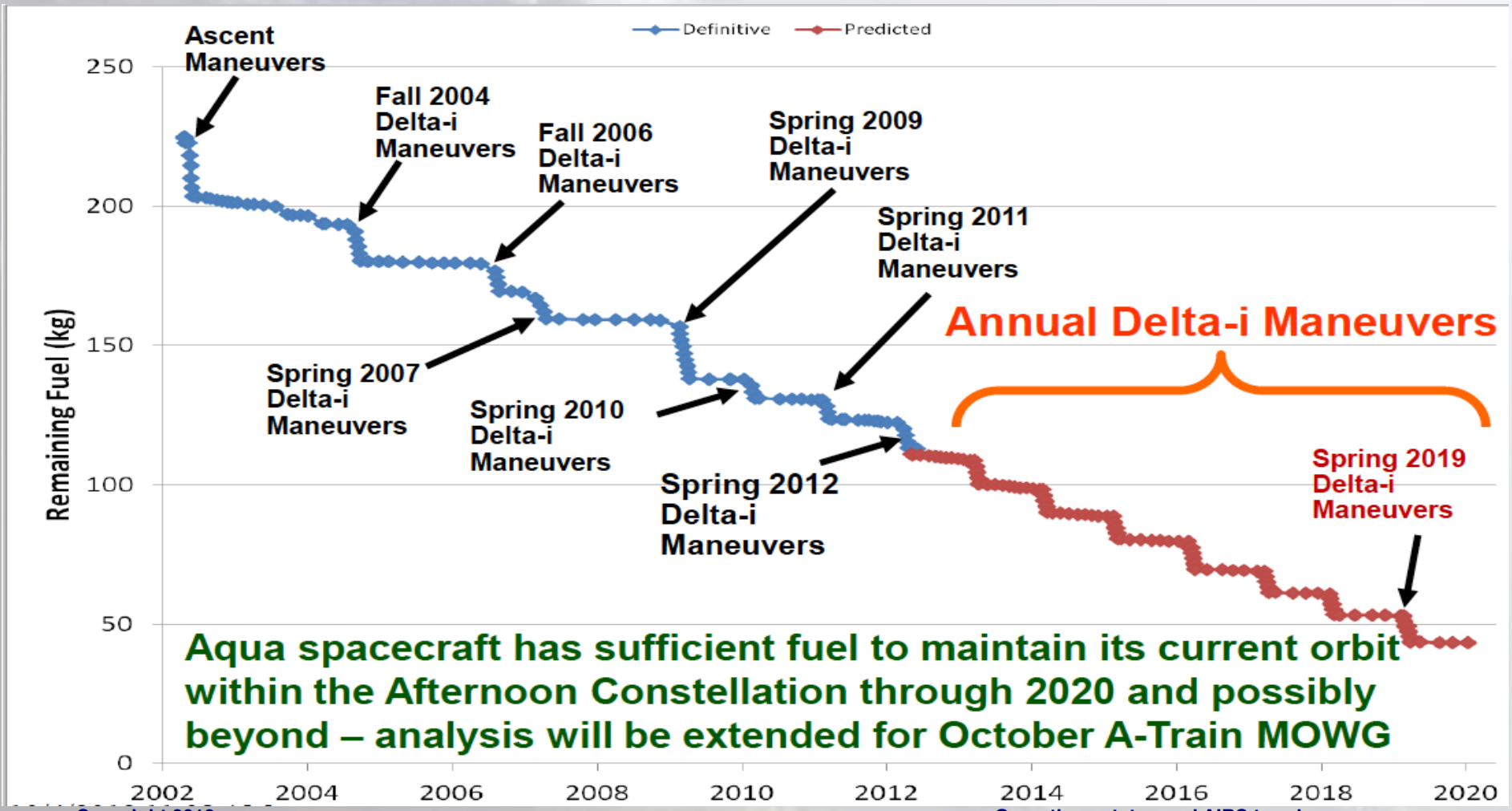
Projected Aqua Fuel Usage



Aqua spacecraft has sufficient fuel to maintain its current orbit within the Afternoon Constellation through 2020 and possibly beyond – analysis will be extended for October A-Train MOWG

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AMSR-E Spin-up Plans

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AMSR-E Anomaly Background

- Suffered numerous anomalies (excess commanded torque and excess current in scanner) over the past several years
- On October 4 2011, in response to the largest of these anomalies yet seen, the instrument was commanded to slow from 40 rpm to 4 rpm
- When problems continued even at 4 rpm the antenna was parked
- Lubricant failure is probable cause
- Spacecraft jitter was seen in AIRS geolocation data during the spin down, but there was no noticeable impact to science on AIRS or any of the other instruments

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AMSR-E Spin-Up

- Not yet declared dead
- AMSR-E team requested a spin-up to 4 rpm to enable cross-calibration with a new instrument, AMSR2, which was launched on GCOM-W1 on May 18 2012
- On September 19 and 20 six attempts were made to spin AMSR-E up to 4 RPM—all failed to reach their goal, but the antenna did complete over 2 revolutions
- Planning for a spin-up to 2 RPM on December 4 is in progress
- JAXA wants AMSR-E to stay at 2 RPM at least two months

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AIRS Trends

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Trends Introduction

- We are now able to examine AIRS trends over a full 10-year period
  - *obs – calc over oceans*
  - *brightness temperature comparisons at specific sites*
  - *AIRS and the automated weather station at Dome C*
  - *Trends in the AIRS spectral frequency shifts*

- We are also able to compare AIRS and IASI over a 5-year period

- For this talk I will just show the AIRS Dome C and spectral frequency trends—the other topics have been or will be covered by others at this meeting

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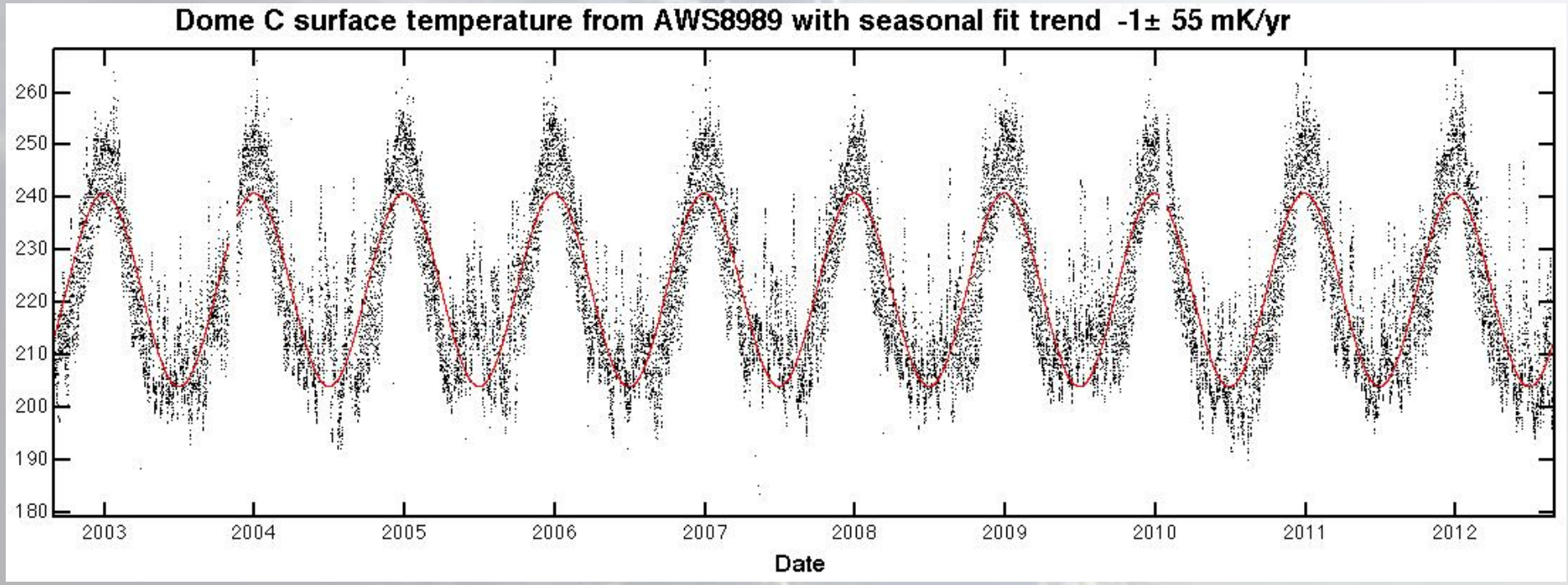
Dome C weather station AWS8989



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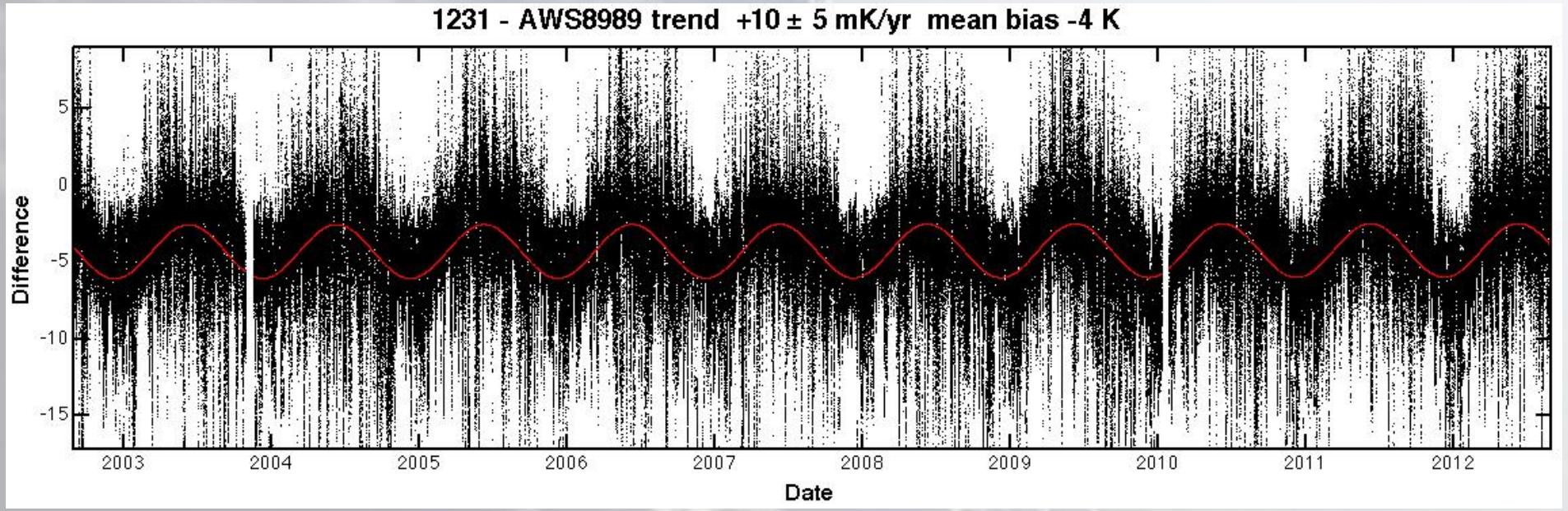
AIRS vs Dome C weather station



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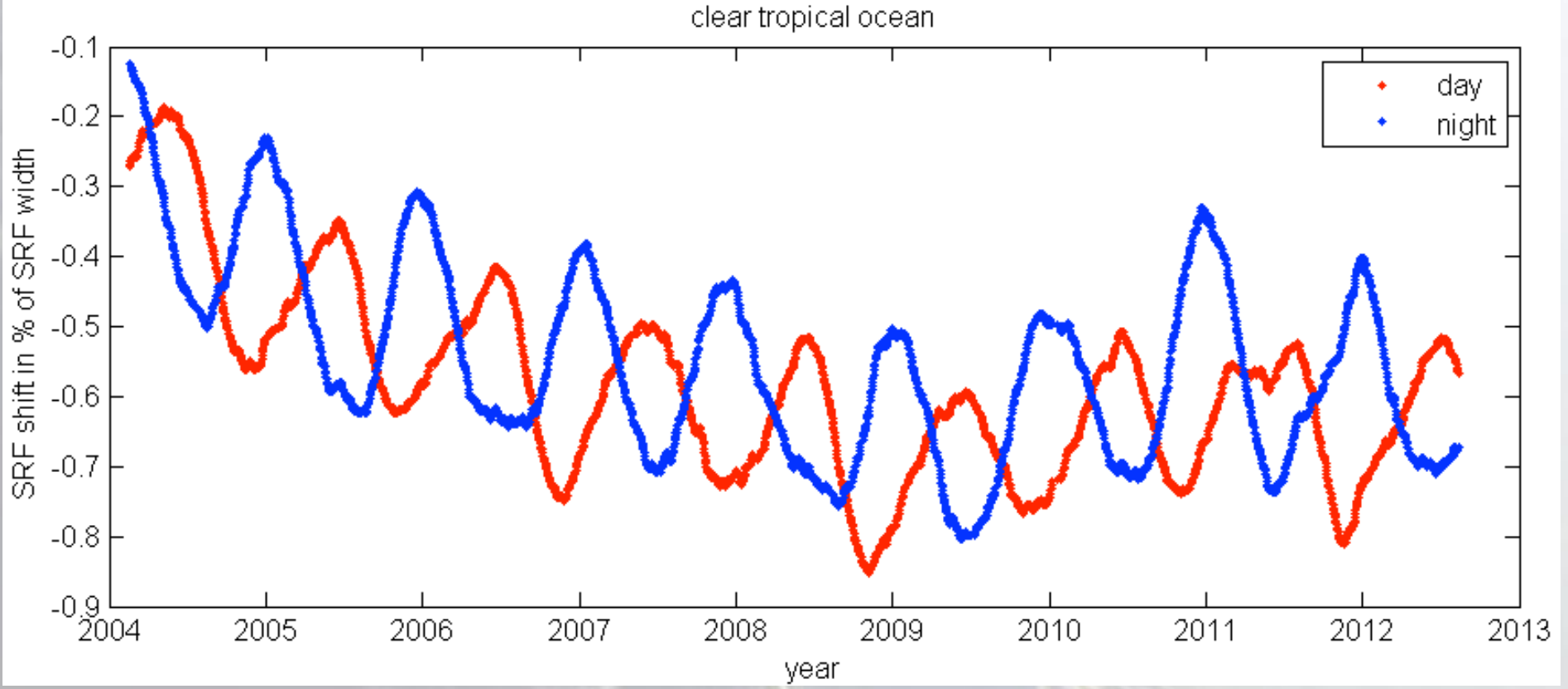
AIRS long-term and seasonal spectral shifts (from Aumann)



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Spectral shifts using channels on slopes of a line (from Aumann)

- **Shifts determined using the difference between channels #448 and #450**
  - ***They straddle the CO_2 Q-branch at 791.7 cm^{-1}***
- **A shift of plus one micron in the focal plane (1% of the SRF width) makes #448 warmer by 0.161K, while it makes #450 colder by 0.122K under tropical ocean clear conditions**
- **This difference is shown on the previous slide**
  - ***between 2002 and 2009 the difference steadily decreased at the rate of -0.028K/yr, corresponding to a focal plane shift of -0.1μm/yr***
  - ***starting in 2009 the shift reversed to +0.03μm/yr***
  - ***superimposed on this long-term trend is a seasonal peak-to-peak modulation of 0.05K (that is 0.2 μm [0.2% of the SRF]) and an orbital oscillation***

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- **Backup**

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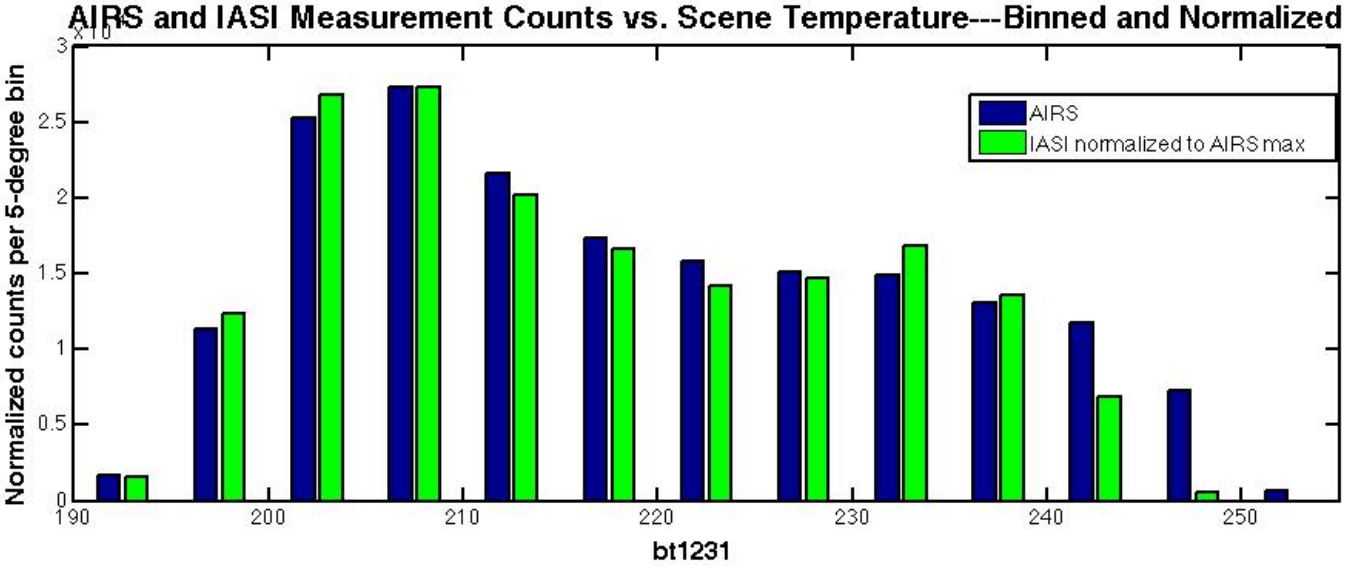
IASI Data Incompleteness Revisited



- The above chart is from the reference
- Note the sharp drop off of IASI spectra counts starting at 240 K
- Above 250 K no IASI spectra appear at all, although AIRS does see some scenes as warm as 255 K

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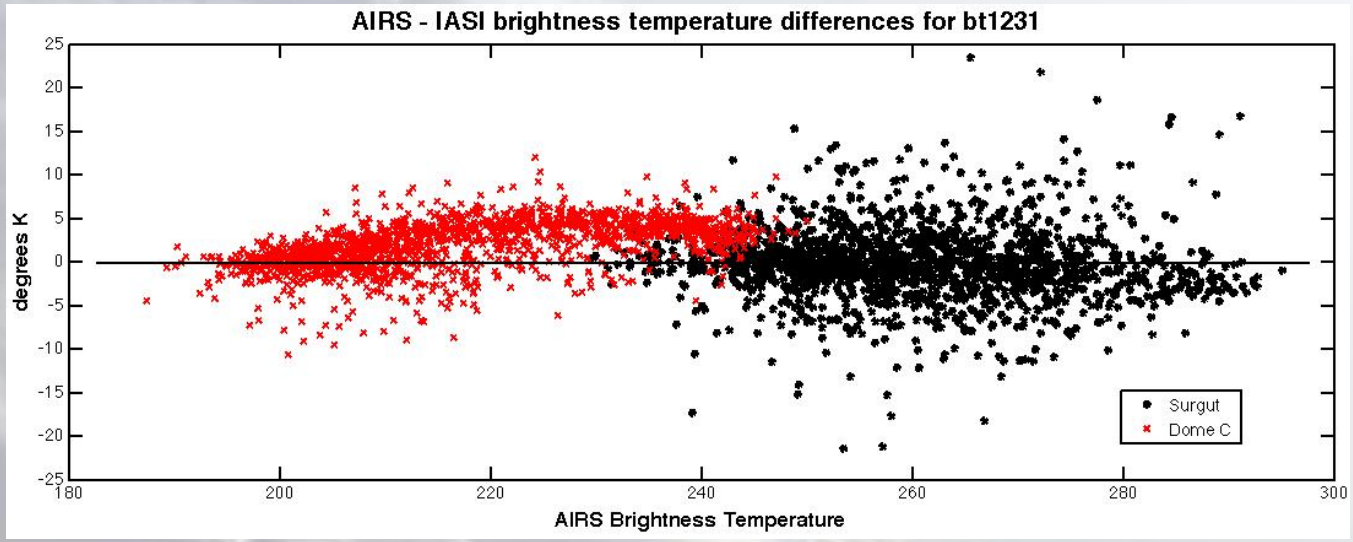
IASI Data Incompleteness—Additional Detail (1 of 2)



- Note that the AIRS versus IASI difference is small at very low temperatures and also at the higher temperatures seen at Surgut
- Note also that for Surgut the difference is near zero all the way down to 230 K (the lowest temperatures seen at Surgut)
- But for temperatures above 215 K at Dome C the difference is as high as 5 K
  - *Apparently, some IASI Dome C spectra are influenced by the interference problem even when they pass the on-board quality check. The observed brightness temperatures are affected.*

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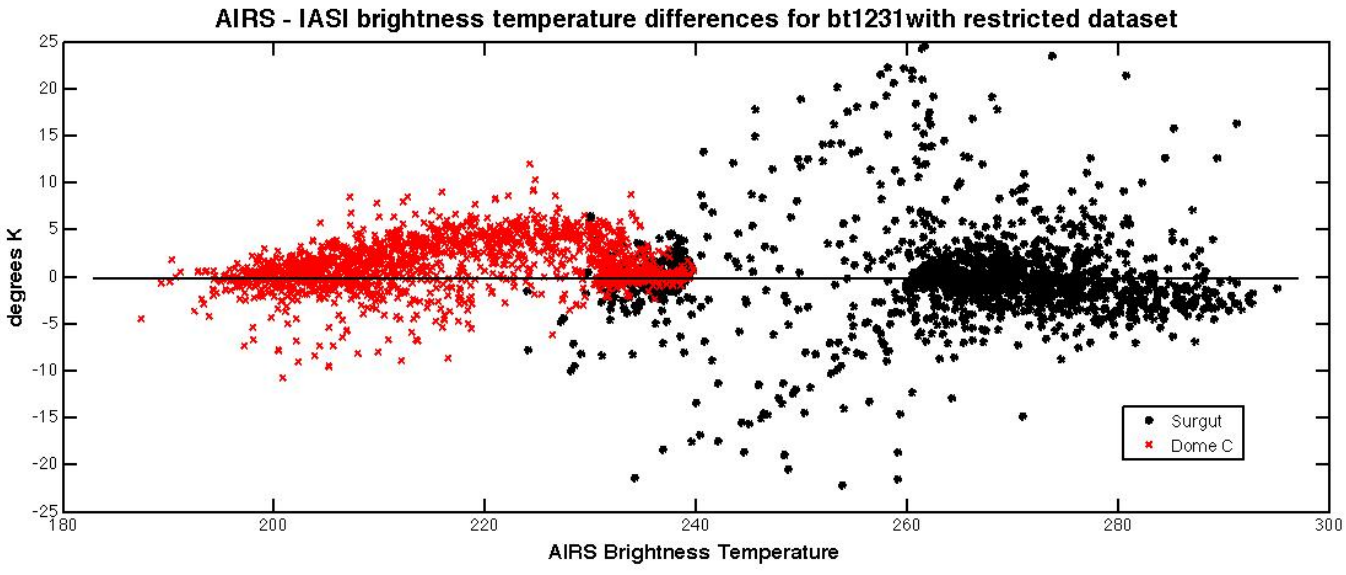
IASI Data Incompleteness—Additional Detail (2 of 2)



- Here, before calculating daily means, we have eliminated all spectra with a brightness temperature in the range 240–260 K
- Of course the noise is increased in and around that range
- Note that the AIRS - IASI difference for Dome C in the range 230 to 240 has noticeably decreased and the distribution has tightened—further evidence that IASI spectra at Dome C are affected by the interference problem even when they pass quality control, at scene temperatures as low as 215 K